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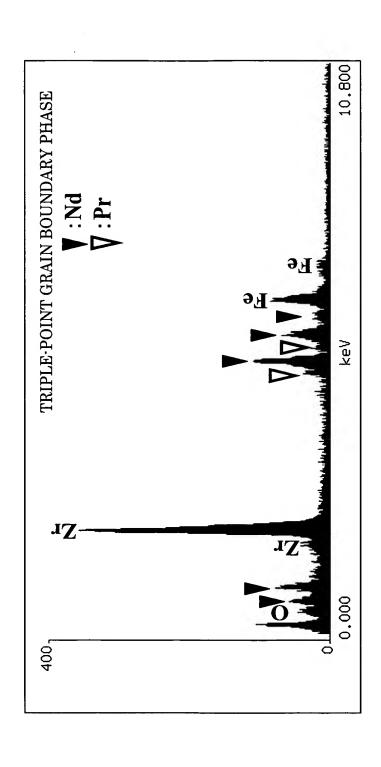
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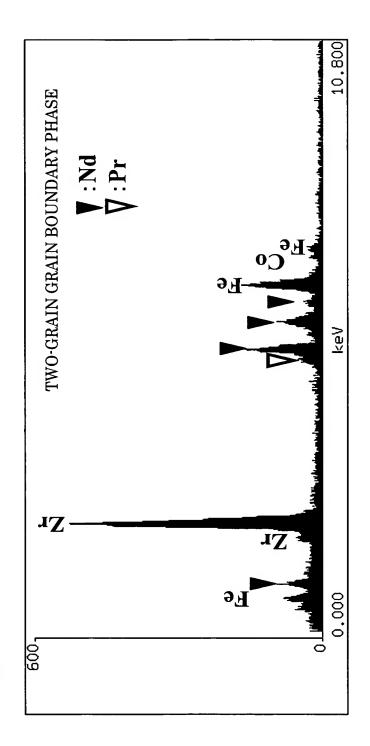


FIG. 2

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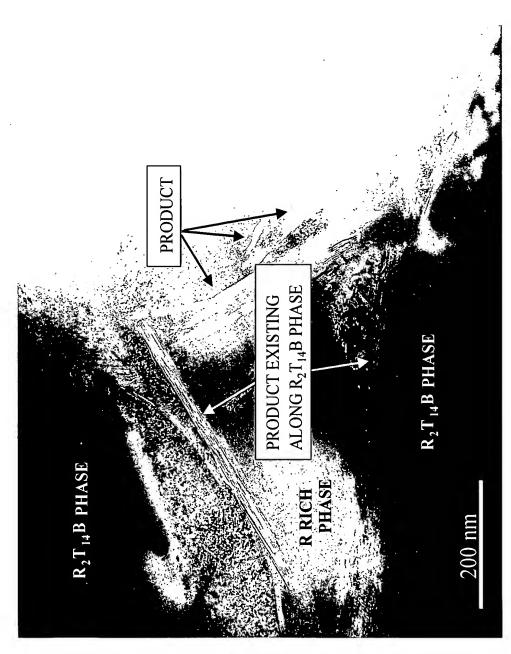


FIG. 3

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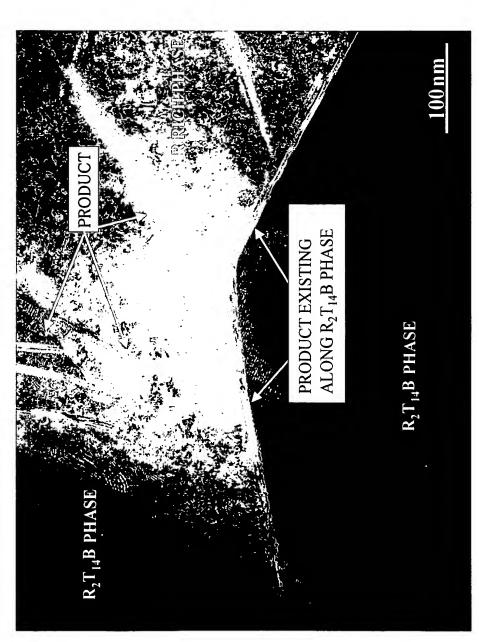
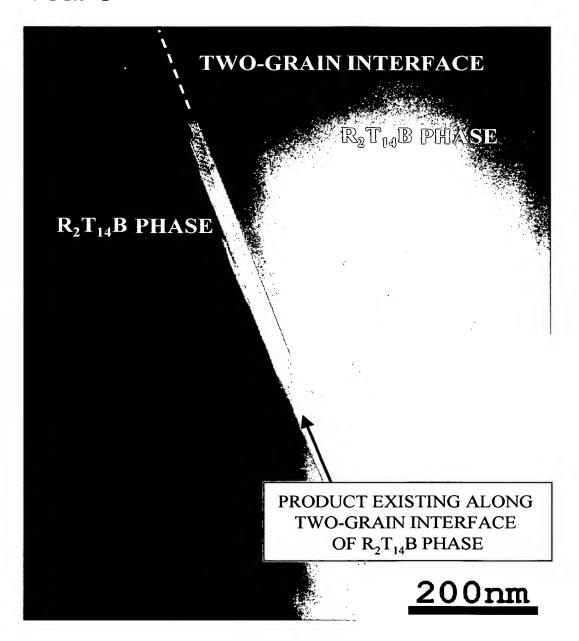


FIG. 4

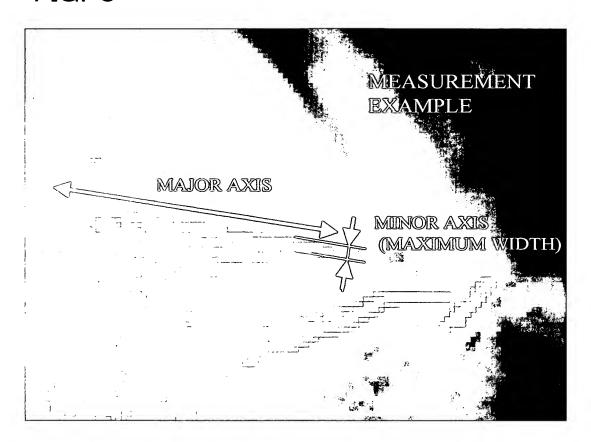
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FIG. 5



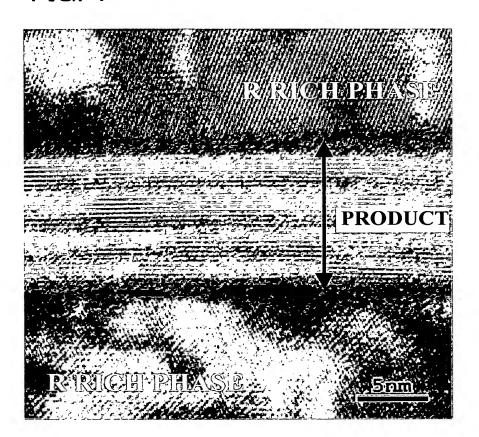
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FIG. 6



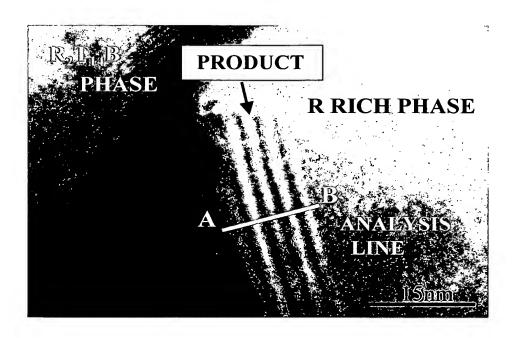
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FIG. 7



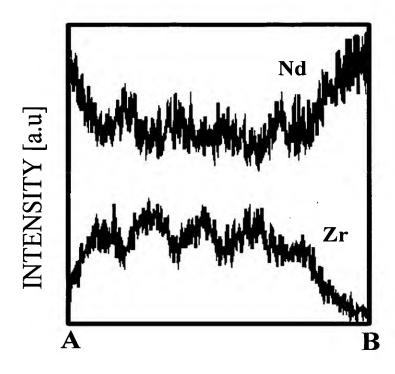
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FIG. 8



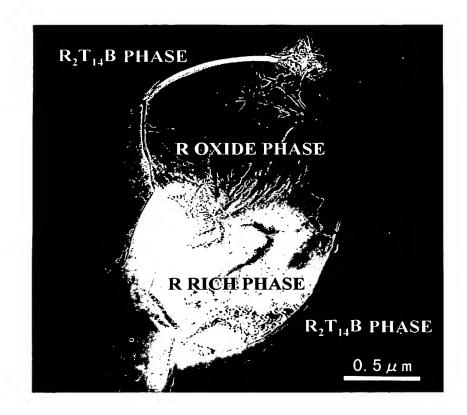
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FIG. 9



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Gouichi NISHIZAWA et al.
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FIG. 10



Hogan & Hartson 81864.0024 Gouichi NISHIZAWA et al. R-T-B System Rare Earth Permanent... Serial No. 10/675,230 filed 09/29/03 33 Drawing Sheets; Sheet 11 of 33

	LOW R ALLOY	23.6Nd-6Pr-0.3Dy-1.1B-0.05Cu-0.2Al-bal.Fe(wt. %)
ALLOY a2 L	LOW R ALLOY CONTAINING Zr	AINING Zr 23.6Nd - 6Pr - 0.3Dy - 1.1B - 0.05Cu - 0.2AI - 0.32Zr - bal.Fe (wt. %)
ALLOY a3 L	LOW R ALLOY CONTAINING Zr	AINING Zr 15.7Nd-6Pr-8.1Dy-1.1B-0.05Cu-0.2AI-0.15Zr-bal.Fe(wt. %)
ALLOY a4 L	LOW R ALLOY CONTAINING Zr	AINING Zr 23.9Nd — 6Pr — 1.1B — 0.05Cu — 0.2AI — 0.15Zr — bal.Fe (wt. %)
ALLOY a5 L	LOW R ALLOY CONTAINING Zr (WITH HIGH AI)	SONTAINING Zr (WITH HIGH AI) 23 .6Nd - 6Pr - 0.3Dy - 1.1B - 0.05Cu - 0.42AI - 0.12Zr - bal.Fe (wt. %)
ALLOY a6 L	LOW R ALLOY CONTAINING Zr (WITHOUT AI)	AINING Zr
ALLOY a7 L	LOW R ALLOY CONTAINING Zr	AINING Zr 27.9Nd - 0.1Dy - 1.1B - 0.03Cu - 0.05AI - 0.08Zr - bal.Fe(wt. %)
ALLOY a8 L	LOW R ALLOY CONTAINING Zr	AINING Zr 23.7Nd - 6Pr - 0.2Dy - 1.6B - 0.3Cu - 0.25Al - 0.3Zr - bal.Fe(wt. %)
ALLOY b1	HIGH R ALLOY (WITHOUT B)	IGH R ALLOY (WITHOUT B) 40.6Nd-0.05Cu-5Co-0.2AI-bal.Fe(wt. %)
ALLOY 52 H	HIGH R ALLOY CONTAINING Zr (WITH B)	40.6Nd-0.5B-0.05Cu-5Co-0.2AI-3.1Zr-bal.Fe(wt. %)
ALLOY b3	HIGH R ALLOY (WITHOUT B AND AI)	I R ALLOY B AND AI)
ALLOY b4	HIGH R ALLOY (WITHOUT B)	THOUT B) 35.1Nd - 0.03Cu - 2Co - 0.05Al - bal.Fe(wt. %)
ALLOY b5	HIGH R ALLOY (WITHOUT B)	THOUT B) 40.6Nd-0.3Cu-20Co-0.25Al-bal.Fe(wt. %)

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							٠	~ /			_									
CV VALUE	1	68	70	99	72	78	101	66	110	159	214	257	281	275	-	81	86	97	223	263
Br+0.1 × HcJ	15.17	15.27	15.28	15.29	15.29	15.30	15.35	15.32	15.24	15.22	15.18	15.14	15.08	15.01	15.03	15.20	15.24	15.21	15.05	15.01
Hk/HcJ Br+0.1 × (%)	38	57	79	96	96	96	97	97	98	63	92	97	86	98	54	97	97	98	96	97
HcJ (kOe)	12.59	13.28	13.29	13.34	13.33	13.31	13.64	13.75	13.85	13.32	13.43	13.56	13.71	13.88	11.44	12.33	12.58	12.81	12.39	12.55
Br (kG)	13.91	13.94	13.95	13.96	13.96	13.97	13.99	13.94	13.85	13.89	13.84	13.78	13.71	13.62	13.89	13.97	13.98	13.93	13.81	13.75
SINTERING TEMPERA- TURE										1070%	2									
HIGH R ALLOYS	ALLOY b1				7	ALLO1 B1					ALLOY 61	+ 3	ALLOY 62		ALLOY b1		ALLOY b1		ALLOY b1	ALLOY b2
LOW R ALLOYS	ALLOY a1				ALLOY a1	ALLOY a2						ALLOY a1			ALLOY a1	ALLOY a1	+ ALLOY a2		100.14	ALLOT a I
AMOUNT OF OXYGEN (ppm)	1210	1290	1160	1360	1090	1190	1110	1320	1240	1350	1400	1170	1220	1310	1888	1820	1920	1870	1800	1960
COMPOSITIONS OF SINTERED BODIES(wt. %)	Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2AI-0.5Co	2 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.01Zr	3 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.02Zr	4 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2AI-0.5Co-0.03Zr	5 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.05Zr	6 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.10Zr	7 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2AI-0.5Co-0.20Zr	8 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.25Zr	9 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.30Zr	10 Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2AI-0.5Co-0.05Zr	11 Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2AI-0.5Co-0.10Zr	12 Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2AI-0.5Co-0.20Zr	13 Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2AI-0.5Co-0.25Zr	14 Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2AI-0.5Co-0.30Zr	15 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2AI-0.5Co	16 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2AI-0.5Co-0.10Zr	17 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2AI-0.5Co-0.20Zr	18 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2AI-0.5Co-0.25Zr	19 Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2AI-0.5Co-0.10Zr	20 Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2AI-0.5Co-0.20Zr
S. O.	Fe-2	Fe-2	Fe-2	Fe-2	Fe-,	Fe-	Fe	Fe -	Fe	Fe-/	Fe-	Fe-	Fe-,	Fe-;	Fe-	Fe-	Fe-,	Fe-,	Fe-	<u> </u>

FIG. 1.

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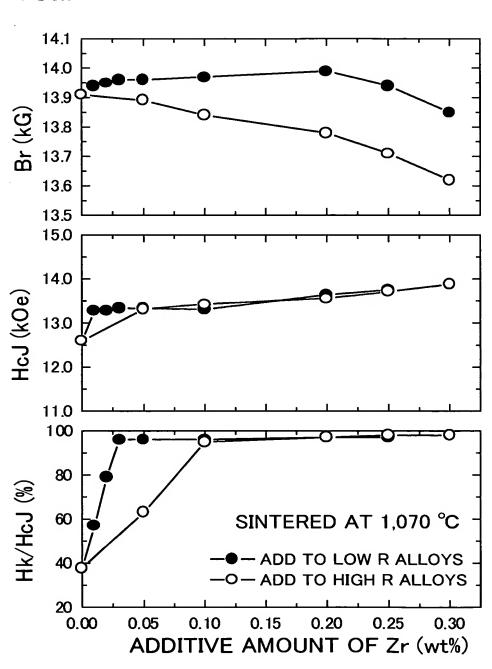
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DDIES(wt.%) OYYGEN AMOUNT OF OYYGEN ALLOYS ALLOYS ALLOYS ALLOYS TEMPERA (kG) (kOe) (96) He.J Hr./He.J Br.01.x 13.94 13.23 91 15.26 Al-0.5Co-0.012r 1180 Al-0.5Co-0.02zr 1100 ALLOY bl HGH R TEMPERA (kG) (kOe) (96) He.J Hc./He.J Hc./He
AMOUNT OF OXYGEN ALLOYS ALLOYS ALLOYS TURE 1210 ALLOY a1 12r 1260 ALLOY a2 1170 ALLOY a2 1170 ALLOY a1 1270 ALLOY a1 1280 127 1280 ALLOY b1 1310 ALLOY b2 1280 1280 1280 1280 1280 1280 1280 128
AMOUNT COW R HIGH R SINTERING Br (kg) OXYGEN ALLOYS ALLOYS TURE 1210 ALLOY a1 ALLOY b1 1210 ALLOY a2 122r 1180 Szr 1360 ALLOY a2 1110 ALLOY a2 1110 ALLOY a2 1110 ALLOY a1 + 13.94 02r 1130 Szr 1300 ALLOY b1 + 13.94 02r 1200 1220 ALLOY a1 + 13.86 02r 1250 ALLOY b2 13.88 1310 ALLOY a5 ALLOY b1 14.15 1180 ALLOY a6 ALLOY b3 13.81
AMOUNT COW R HIGH R SINTERING OXYGEN ALLOYS ALLOYS TURE (ppm) 1210 ALLOY a1 ALLOY b1 1210 ALLOY a1 ALLOY b1 52r 1180 + + ALLOY b1 52r 1300 ALLOY a2 ALLOY b1 1220 ALLOY a1 ALLOY b1 1220 ALLOY a5 ALLOY b1 11310 ALLOY a5 ALLOY b1 1140 + + + + + + + + + + + + + + + + + + +
AMOUNT COWR HIGH R OXYGEN ALLOYS ALLOYS (ppm) 1210 ALLOY a1 ALLOY b1 1210 ALLOY a2 22r 1180 32r 1360 ALLOY a2 52r 1110 ALLOY a2 62r 1170 02r 1200 62r 1200 62r 1370 ALLOY a1 64 + + + + + + + + + + + + + + + + + + +
AMOUNT OXYGEN OXYGEN (ppm) 1210 1210 1210 1210 02r 1130 02r 1300 02r 1300 02r 1300 02r 1300 02r 1300 1120 01110 1140 1180
AMOUNT OXYGEN OXYGEN (ppm) 1210 1210 1210 1210 02r 1130 02r 1300 02r 1300 02r 1300 02r 1300 02r 1300 1120 01110 1140 1180
22r 22r 32r 32r 55r 55r 02r 02r
DDIES(wt. %) Al-0.5Co Al-0.5Co-0.01Zr Al-0.5Co-0.03Zr Al-0.5Co-0.05Zr Al-0.5Co-0.10Zr
No. COMPOSITIONS OF SINTERED BODIES(wt. %) 21 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.01Zr 22 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.02Zr 23 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.03Zr 25 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.03Zr 26 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.05Zr 27 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.05Zr 28 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.10Zr 30 Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2Al-0.5Co-0.10Zr 31 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.03Al-0.5Co-0.10Zr 32 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.03Al-0.5Co-0.10Zr 33 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.03Al-0.5Co-0.10Zr 34 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.03Al-0.5Co-0.10Zr 35 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.03Al-0.5Co-0.10Zr 36 Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.03Al-0.5Co-0.10Zr
No. 22 23 24 24 24 25 25 26 26 26 28 33 33 33 35 35 35

-1G. 1

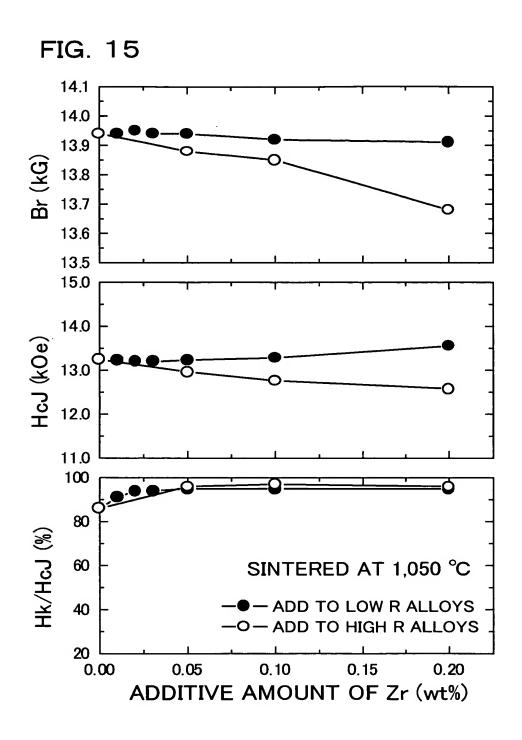
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FIG. 14



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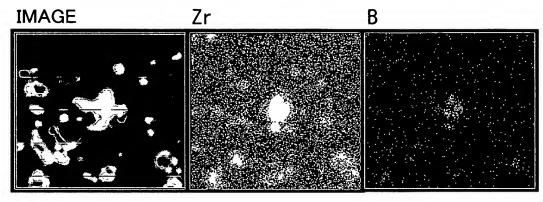


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FIG. 16

COMPOSITION

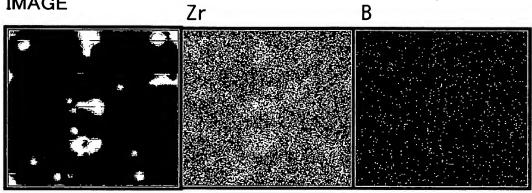


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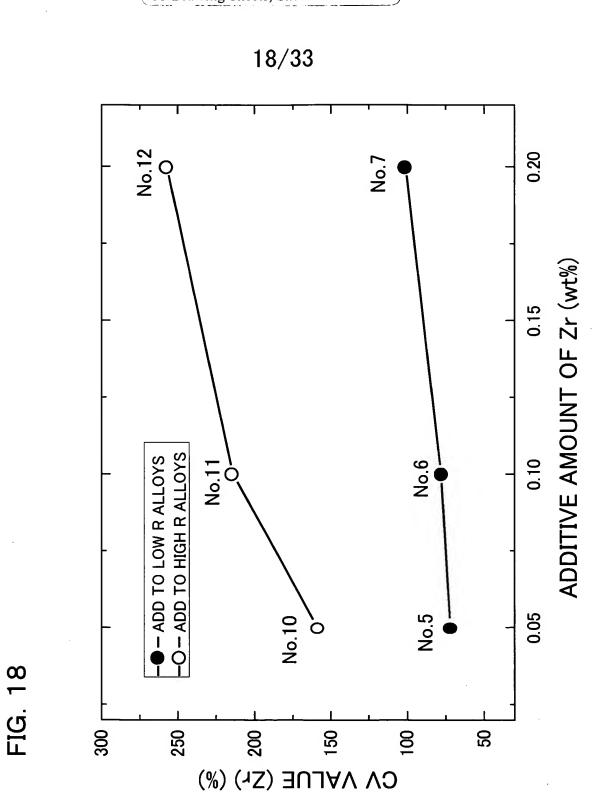
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FIG. 17

COMPOSITION IMAGE



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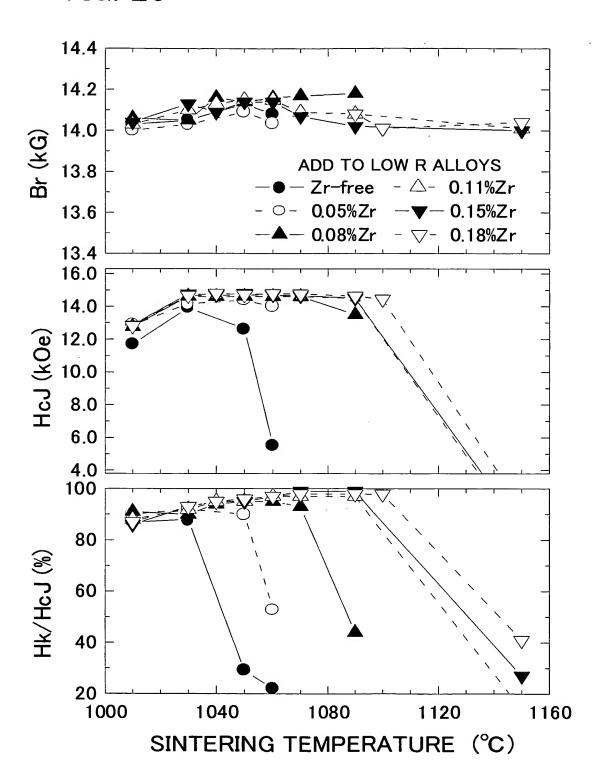
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FIG. 19

No.	COMPOSITIONS OF SINTERED BODIES (wt. %)	AMOUNT OF OXYGEN (ppm)	SINTERING TEMPERA- TURE	Br (kG)	HcJ (kOe)	Hk/HcJ (%)	Br+0.1 × HcJ	CV VALUE
36			1010℃	14.03	11.68	87	15.20	-
37	Fe-24.9Nd-5.4Pr-0.4Dv-1B-0.05Cu-0.2AI-0.5Co	680	1030℃	14.05	13.92	88	15.44	-
38	F8-24.9Nd-3.4F1-0.4Dy-1B-0.03Cd-0.2AI-0.3C0		1050℃	14.13	12.64	29	15.39	-
39			1060℃	14.08	5.53	22	14.63	-
40			1010℃	14.00	12.84	90	15.29	
41	Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2AI-0.5Co-0.05Zr	670	1030℃	14.03	14.17	92	15.44	-
42	F6-24.5Nd-3.4F1-0.4Dy-1B-0.03Cd-0.2AI-0.3C0-0.0321		1050℃ [°]	14.09	14.37	90	15.53	_
43		<u> </u>	1060℃	14.04	14.00	53	15.44	-
44			1010℃	14.06	12.76	91	15.33	-
45			1030℃	14.05	14,61	90	15.51	
46			1040℃	14,16	14.59	94	15.62	-
47	Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.08Zr	870	1050℃	14.14	14.61	95	15.60	-
48			1060℃	14.16	14.60	95	15.62	
49			1070℃	14.17	14.60	93	15.63	_
50			1090℃	14.18	13.51	44	15.53	
51			1010℃	14.03	12.85	88	15.31	65
52			1030℃	14.10	14.67	92	15.57	71
53			1040℃	14.13	14.66	95	15.59	77
54	5 04001 540 040 40 0050 0041 050 0447	700	1050℃	14.15	14.71	95	15.62	75
55	Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.11Zr		1060℃	14.15	14.69	97	15.62	72
56			1070℃	14.09	14.61	97	15.55	75
57		l	1090℃	14.08	14.49	97	15.53	81
58			1150℃	14.01	0.11	14	14.02	142
59			1010℃	14.04	12.85	86	15.32	68
60		<u> </u>	1030℃	14.13	14.72	93	15.60	75
61			1040℃	14.09	14.77	95	15.57	72
62	E 04001 540 040 40 0000 0001 000 0457	740	1050℃	14.14	14.79	95	15.62	80
63	Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.15Zr		1060℃	14.14	14.72	97	15.61	85
64			1070℃	14.07	14.66	99	15.53	88
65			1090℃	14.02	14.51	99	15.47	91
66			1150℃	14.00	0.50	27	14.05	150
67			1010℃	13.98	12.81	87	15.26	-
68			1030℃	14.07	14.67	93	15.54	-
69			1040℃	14.13	14.80	95	15.61	
70			1050℃	14.05	14.72	96	15.52	
71	Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.18Zr	810	1060℃	14.18	14.78	97	15.65	_
72	·	•	1070℃	14.03	14.76	98	15.51	_
73			1090℃	14.08	14.63	98	15.54	
74			1100℃	14.01	14.45	98	15.46	-
75			1150℃	14.04	1,75	41	14.22	

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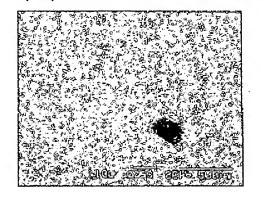
FIG. 20



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FIG. 21

(a) No. 37 1030°C Zr-free



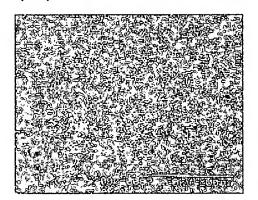
(b) No. 39 1060°C Zr-free



(c) No. 43 1060°C 0. 05%Zr

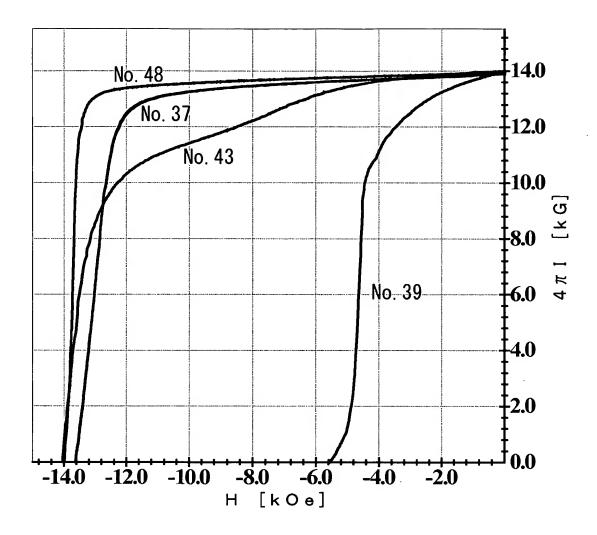


(d) No.48 1060°C 0.08Zr



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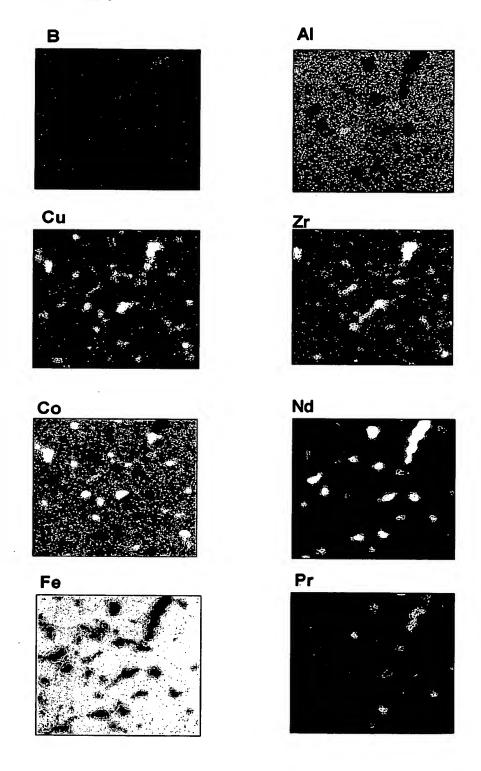
FIG. 22



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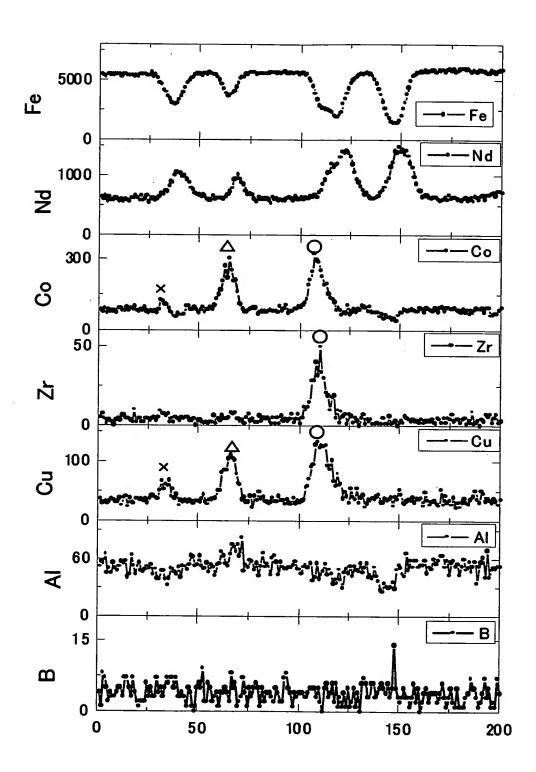
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FIG. 23



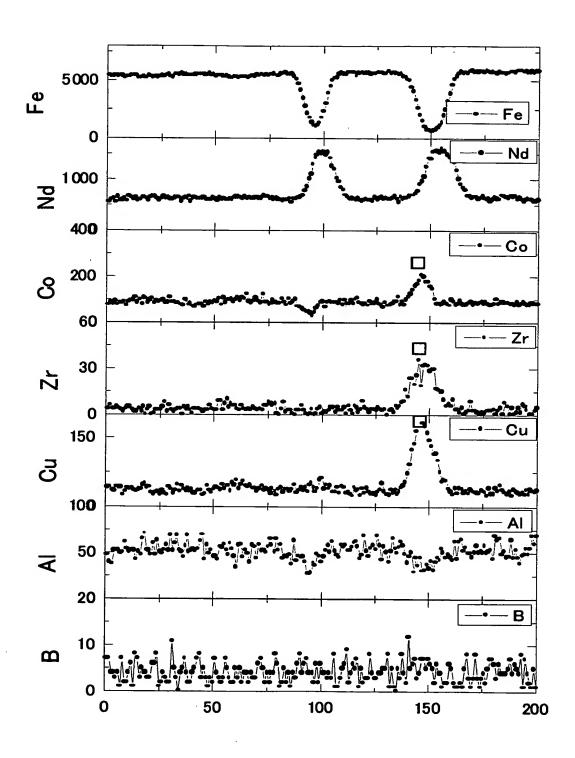
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FIG. 24



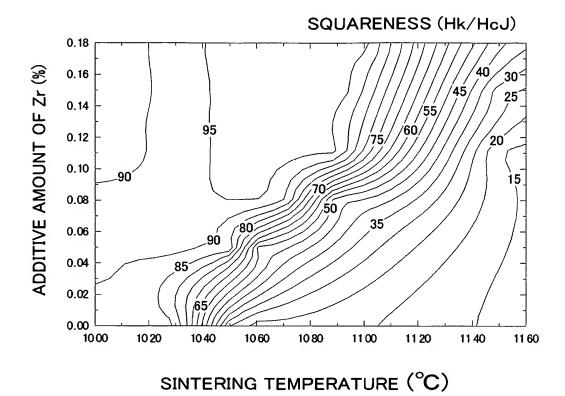
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FIG. 25



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FIG. 26



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N _o	COMPOSITIONS OF SINTERED BODIES(wt. %)	LOW R ALLOYS	HIGH R ALLOYS	SINTERING TEMPERA- TURE	Br (kG)	HcJ (k0e)	NG Br HcJ Hk/HcJ E	HcJ Hk/HcJ Br+0.1 x (kOe) (%)
9/	76 Fe-25.0Nd-5.3Pr-1B-0.05Cu-0.2Al-0.5Co-0.13Zr	ALLOY a4		1060°C 14.42 12.62 98	14.42	12.62	86	15.68
11	77 Fe-23.2Nd-5.4Pr-2.1Dy-1B-0.05Cu-0.2Al-0.5Co-0.13Zr	ALLOY a1	>0	J°0701	13.68		17.3	15.41
78	78 Fe-20.6Nd-5.4Pr-4.7Dy-1B-0.05Cu-0.2Al-0.5Co-0.13Zr	ALLOY a2	אררסו מו		13.19	13.19 23.23	86	15.51
79	79 Fe-19.0Nd-5.3Pr-7.2Dy-1B-0.05Cu-0.2Al-0.5Co-0.13Zr	ALLOY a3		1090°C 12.37 30.51 94	12.37	30.51	94	15.42

FIG. 27

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TYPE		Nd (wt%)	Pr (wt%)	Dy (wt%)	Co (wt%)	Cu (wt%)	AI (wt%)	B (wt%)	Zr (wt%)	Ге
	LOW R ALLOY	23.6	0.9	0.3	1	0.05	0.23	1.1	0.11	bal.
∢	HIGH R ALLOY	40.6	{	I	5.0	0.05	0.23	ı	l	bal.
	COMPOSITION OF SINTERED BODY	25.0	5.3	0.3	0.5	0.05	0.23	1.0	0.10	bal.
	LOW R ALLOY	23.6	0.9	0.3	ł	0.05	0.23	1.1	ı	bal.
۵	HIGH R ALLOY	40.6	I	I	5.0	0.05	0.23	0.5	2.0	bal.
	COMPOSITION OF SINTERED BODY	25.0	5.3	0.3	0.5	0.05	0.23	1.1	0.10	bal.

FIG. 28

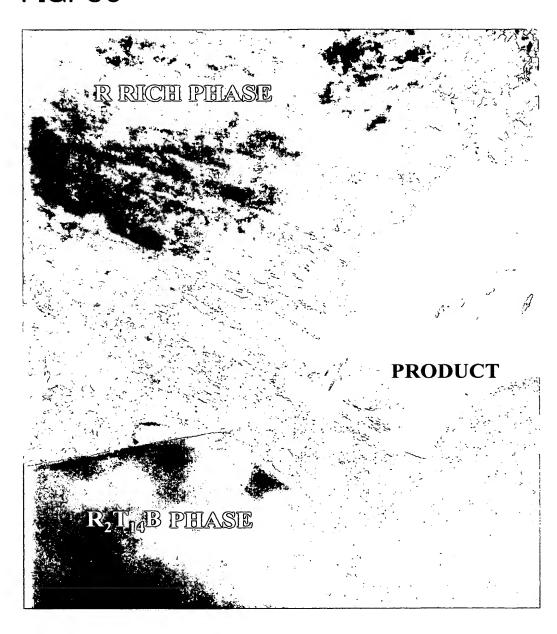
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		Zr	02	N	SIZE OF P	SIZE OF PRODUCT (AVERAGE)	VERAGE)	SINTERING
ТҮРЕ	Zr Adding METHOD	ADDITIVE AMOUNT [wt%] [ppm] [ppm]	[bbm]	[bbm]	MAJOR AXIS [nm]	MINOR AXIS [nm]	AXIS RATIO	TEMPERATURE [°C]
А	LOW R ALLOY 0.1	0.1	029	350	310	15	22.7	1050
В	HIGH R ALLOY 0.1	0.1	850	300	166	15	11.2	000

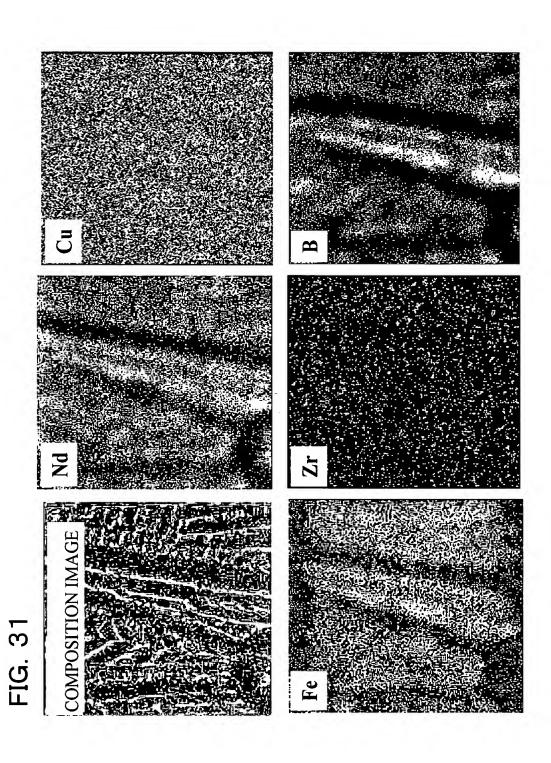
FIG. 29

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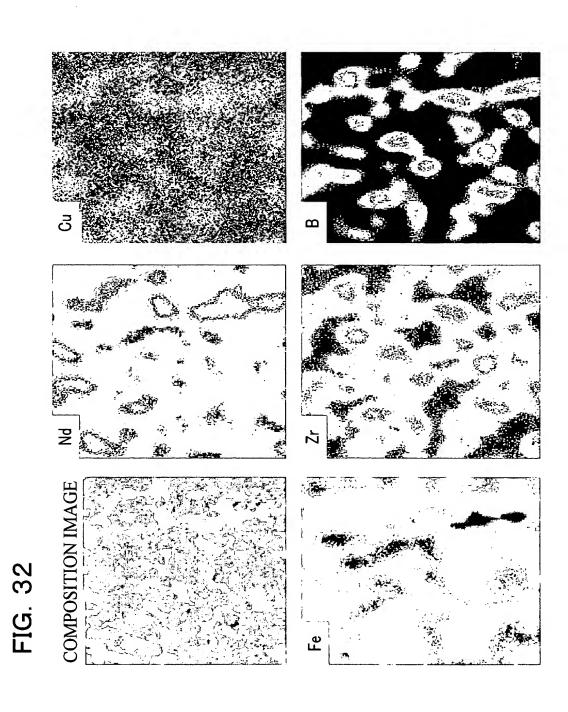
FIG. 30



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No.	COMPOSITIONS OF SINTERED BODIES(wt. %)	AMOUNT OF OXYGEN A (ppm)	MOUNT COW R HIGH R DXYGEN ALLOYS (ppm)	HIGH R ALLOYS	SINTERING Br HcJ Hk/HcJ Br+0.1 × TURE (kG) (kOe) (%)	Br (kG)	HcJ (kOe)	Hk/HcJ (%)	Br+0.1 × HcJ	CV VALUE
8	80 Fe-28.3Nd-0.1Dy-1B-0.03Cu-0.05Al-0.2Co-0.07Zr	720	ALLOY a7	ALLOY b4	720 ALLOY a7 ALLOY b4 1070°C 14.62 13.1	14.62	13.1		98 15.93	77
8	81 Fe-26.9Nd-4.8Pr-0.2Dy-1.3B-0.3Cu-0.25Al-4Co-0.24Zr	086	ALLOY a8	ALLOY _{b5}	980 ALLOY a8 ALLOY b5 1020°C 13.88 15.3	13.88	15.3		96 15.41	98